

THE HABITAT OF CERTAIN SPECIES OF *CLAUSILIA* FROM
DALMATIA, HERZEGOVINA, AND BOSNIA.

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A RECENT excursion into Dalmatia, Herzegovina, and Bosnia gave me an opportunity of making some observations upon certain of the Land Mollusca. The results of these observations may prove interesting to those who study, not the shell, nor the 'animal,' but the habits and modes of life of the creature as a whole.

The first point that struck me was this. Although April was well advanced (I was in the country from the 11th till the 28th), and the warmth considerable, summer clothes being a necessity even at Sarajevo, 1,800 feet above the sea, the Mollusca were still hibernating, with certain remarkable exceptions. *Clausilia*, *Pupa*, and *Pomatias* were lively and abundant; of the Helicidæ, the only species that could be said to be 'out' was *austriaca*, Mühl., but *Velebitana*, Zieg., and *setosa*, Zieg., appeared to be just awakening, while others had to be hunted out in their lairs. The great *Zonites* (*acies*, L., *compressus*, Zieg.) and *Glandina* (*Algira*, L.) were still in winter retirement, some way below the surface of the ground. It looked as though the smaller-sized genera were better equipped for resisting cold than the larger, or perhaps their more elongated form makes it impossible for them to feed up for the winter, and to get into such good condition as their larger brethren.

It was therefore to *Clausilia* that my attention was more particularly directed. One cardinal fact soon impressed itself with regard to this genus. Variety of habitat was its prime characteristic. The first species which occurred was at Pola, where a form of the common *Cl. papillaris*, L., was nestling in twos and threes in shaded cracks of dry walls and rocks. In the mountains behind Spalato, at a height of about 1,200 feet, *Cl. fulcrata*, Zieg., was found in quantity under similar conditions. But at 1,000 feet lower level, where the River Jadro issues fully-grown from the face of the limestone cliff, *Cl. archilabris*, Küst., was found plentifully on smooth rocks, never in groups, like the two species just named, but almost invariably one at a time. On the Monte Mariano, about 600 feet above Spalato, *Cl. semirugata*, Zieg., occurred abundantly under large stones, but not in the open, although rocks abounded all round, while in the same locality *Cl. Cattaroensis*, Küst., was found on the rocks, but never under stones.

A further contrast was noticeable at the lovely defile of Almissa, to which I made a special expedition in order to obtain the magnificent species—surely the largest *Clausilia* in Europe—which takes its name from the spot. So fine a shell is it, that I could hardly believe my good fortune when my eyes lighted upon the first individual. But it was no use looking for it in cracks, or in old walls, or under stones, or in any of the haunts usually dear to *Clausilia*. It occurred on the bare

open face of the cliffs, in spots where a slight trickle of water kept the great smooth slabs perpetually moist. This was its regular habitat, though now and then an individual might be found in the dry. A variety, *major*, was afterwards detected in a somewhat similar habitat at Duare. Associated with it at Almissa was another species not half the size, as yet unidentified, but belonging to the *Cattaroensis* group. This species only occupied the cracks, or nestled under the ledges, while *Almissana* paraded about boldly in the open, a most conspicuous object.

At Ragusa I found several species, each under circumstances peculiarly its own. *Cl. exarata*, Zieg., lives on hollow damp limestone rocks, not merely gregariously, but under circumstances which suggest extreme overcrowding. I must have taken from 10 to 15 individuals, several times over, from one small hole in the rock. And this tight packing was not due to scarcity of suitable domicile, for there were quantities of similar holes quite unoccupied; they evidently loved to squeeze closer together than I have ever seen *Clausilia* live. At the island of Lacroma a more slender form of the same species occurred in cracks of rocks which hung over the sea. It was quite a new sensation, gathering *Clausilia* with one's feet in the sea-water. At Lacroma also *Cattaroensis* occurred, in complete contrast to *exarata*, in single and solitary specimens on a damp old wall.

An expedition to the source of the Ombla, behind Gravosa, taught me a fresh lesson about *Clausilia*. For I knew there must be a species there, but though I looked on walls, in cracks, in damp places, under herbage growing on rocks, I could find nothing. At last a happy accident revealed to me the fact that *celestina*, Küst., cares for none of these places, but hangs on bare and very dry rock faces, provided only they do not look full south. Its colour greatly resembles that of the rock. When I grasped this fact I found them in dozens, never crowding together like *exarata*, nor at long distances apart like *Cattaroensis*, but evenly and abundantly distributed over the whole rock surface.

After an expedition to Castelnuovo, on the Bocche di Cattaro, which was fruitless as regards *Clausilia*, but which yielded a few specimens of the fine *Pomatias auritus*, I came through Mostar, the capital of Herzegovina, to Jablanica, at the head of the great Narenta defile, hoping for rich booty. Never was I more disappointed. The rocks were of that soft disintegrated slaty type which never yields anything, and complete failure seemed imminent. I argued, however, that if I went back to where the defile narrows sharply (Jablanica is on a marked widening out of the valley) I should get upon the harder limestone again, with a better chance of success. For a long time this plan was without result, but it was again a case of looking in the wrong place. For, this time, it was not the limestone slabs or crannies themselves, but a peculiar band of conglomerate running through the limestone near Prenj, that furnished *Cl. albocincta*, Pfr., in considerable numbers. A vein of clay ran in and out of the conglomerate, and on this, apparently a most unpromising locality, the species clung in quantity. What its food could be puzzled me at the time, for there

was nothing green anywhere near, but a theory suggested itself, to which I recur later on.

At Sarajevo, my next objective, it was a joy to find that fine species *Cl. Dacica*, Friv., under grass in the cracks of rocks on the banks of the Miljaška, not five minutes from the Rathhaus. One does not usually find a giant *Clausilia* so near to the walls of the town hall of a capital city.

From Sarajevo the next move was to Jajce, and on the road I had yet another lesson that it takes more ways than one to find *Clausilia*. At a junction called Lašva we had 15 minutes to wait, and I strolled down a shabby path past an engine-house, at the foot of the railway embankment. Here was a scree of small black stones; I turned one or two over, not expecting any result, and found the under side swarming with *Cl. vetusta*, Zieg. This species seemed to live by preference among the roots of dead or decaying grass.

Jajce, besides its extreme natural beauties, is a fine locality for the collector. The castle walls yielded *Cl. decipiens*, Rossm., and *vetusta*, Zieg., the former abundant, the latter scarce, but both living between the stones of which the castle wall is composed. The same locality, it may be mentioned, gave me *Zonites acies*, L., and *compressus*, Zieg., with *Helix planispira*, Lam. Now came a more serious piece of work. In Dr. Norman's collection of European Land Mollusca, acquired by the British Museum, there is a noble species of *Clausilia*, labelled by Dr. Brancsik "*Cl. Bosnensis*, Zieg., var. *Plivæ*, Brancs., Jajce, Felsen am rechten Plivaufers." I naturally determined to have it, and spent most of an afternoon hunting the rocks on the southern bank of the Pliva, just before it falls into the Urbas in that beautiful cascade. Not a sign of it could be seen. At last a cliff was visited, at the foot of which a few dead specimens were noticed. Then one and then more living specimens were found, until a fair number had passed into the collecting-box. But it was another instance of looking in the right place. All localities, however promising, were vain, until I discovered that it was again the fact that the creature preferred absolutely bare rock to those clothed with greenery. Here were a few scanty mosses, and on these, in the late afternoon, the creature emerged to feed, leaving the ledges and deep cracks in the limestone in which it had hidden during the day.

Yet once more was the lesson impressed upon me that the ways of *Clausilia* are not learned in a week. From Jajce I drove 45 miles to Banjaluka. On the way I closely observed the rocks of the grand defile, and detected nothing at all. The post waggon stops at a little place called Boćac for midday meal, and while it was preparing I strolled along the road examining the cliffs, which were full of admirable and attractive cracks, well supplied with green food, and absolutely destitute of *Clausilia*. The road at a certain point makes a tiny cutting through the rock, and leaves, on the side opposite to the cliff, a little isolated crag of bare limestone. I strolled past this crag without examining it, as it appeared quite hopeless. On my return, entirely empty-handed, it struck me—"that rock will be in shade, the cliff is all in sun." In 15 minutes, with the help of two

little Bosnian maidens, who, in return for sundry coin of the realm, turned themselves into ardent naturalists, I had amassed 179 specimens of the fine *Cl. Bosnensis*, Zieg., from this single dry limestone crag, the face of which measured perhaps 12 yards by 3.

This brings me to my final point. I feel quite certain that the food of many species of *Clausilia*, and I think it probable that I might add of *Pupa* and of *Pomatias*, is not green herbs of any kind. I believe that they devour the surface of the limestone on which they live. If we rub the limestone with our finger something 'comes off,' and leaves a mark. I believe this is what *Clausilia* devours, for I have frequently seen them living in spots where no green thing was accessible, and I have good reason for believing that normally they feed every day. Probably some minute organisms—of what nature I do not here discuss—live on the disintegrated surface of the limestone, and it is on these that the animals feed. Further, I believe that they do so, not by selecting the organisms themselves, but by swallowing the soft surface of the limestone whole, after rasping it off with their radulæ. In the case of *Cl. Almissana*, noticed above as preferring to live on bare limestone cliffs where there was a trickle of water, the food is probably minute water organisms, devoured in a similar way. And in confirmation of this view I may be permitted to refer to an article in the *Journal of Malacology*, vol. xii, pp. 74-5, in which I advanced the theory, based upon a chemical examination of the excreta, together with a consideration of its life-habits, that *Helix desertorum* nourishes itself by swallowing large quantities of sand, on which minute gelatinous organisms (*Nostoc* and the like) find a home.
